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MANURIAL TRIALS WITH SUGAR CANE.

S. J. SAINT, M.Sc., Ph.D., F.I.C.

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SECTION I.

THE EFFECT OF VARYING COMBINATIONS OF NITROGEN AND POTASH ON THE YIELD AND PER CENT. SUCROSE IN JUICE.

I. PLANT CANES. (1933–1935).

As shown in previous trials, the principal limiting factors affecting the yield of cane under Barbados conditions are water, potash and nitrogen. The water factor varies with the rainfall and it is therefore necessary to carry out trials from year to year, under different rainfall conditions, with varying combinations of nitrogen and potash manuring in order to ascertain the effect of the three variables.

Two types of trial on plant cane are described in the first part of this Section. The first type was carried out with three different applications of nitrogen and potash at two centres, whilst type two was planned with four different applications of nitrogen and potash and was put down at one centre.

TYPE I.

CENTRES.

Two centres were selected for this trial (a) a red soil centre with, on the average, a high rainfall and (b) a black soil centre with, on the average, a low rainfall.

PLAN.

The lay-out was in the form of six randomised blocks. There were nine treatments. The varying amounts of nitrogen and potash applied were 0, 60 and 120 lb. per acre respectively. The size of each plot was 56 cane holes (approximately 1/30 acre) and the inside 42 holes were cut and weighed in the estimation of yield. For sucrose determinations, a representative sample of cane weighing approximately 100 lb. was selected for each treatment from each block for analysis making a total of 54 samples.

RAINFALL.

The rainfall for the growing period December 1933—February 1935 measured 72.23 inches at the red soil centre as compared with an average of approximately 89 inches for the same months between the years 1890—1929 and 31.85 inches at the black soil centre as against an average of approximately 52 inches for the same months between the years 1890—1929. The rainfall was thus much below the average at both centres. The distribution of the rainfall over the different months of the year is set out in Figs. I and II.

YIELD RESULTS.

The yield results in terms of tons of cane and the percentage sucrose in the juice are set out in Table I for the means of six plots of each treatment for each centre.

TABLE I.

Plot No.	Treatment (per acre)		Means of six plots.			
			Black Soil Centre.		Red Soil Centre.	
	January lb K_2O	July Lbs. N.	Tons Cane.	Per Cent. Sucrose in Juice.	Tons Cane.	Per Cent. Sucrose in Juice.
1	0	0	14.5	18.20	26.3	18.96
2	0	60	14.3	18.31	26.9	18.61
3	0	120	13.7	18.26	27.7	18.71
4	60	0	14.5	18.06	29.4	18.88
5	60	60	14.4	18.49	30.3	19.11
6	60	120	14.1	18.11	28.8	18.31
7	120	0	15.5	18.26	30.5	19.11
8	120	60	14.3	18.37	32.1	19.50
9	120	120	13.5	18.26	31.2	18.88

N = Nitrogen as Sulphate of Ammonia.
K_2O= Potash as Muriate of Potash.

If the effects on the yield of the different doses of nitrogen or potash are considered separately and the effect, if any, of the other constituent is ignored, it is possible to consider the differences between the means of eighteen plots for each addition of nitrogen or potash and hence add to the precision of the experiment.

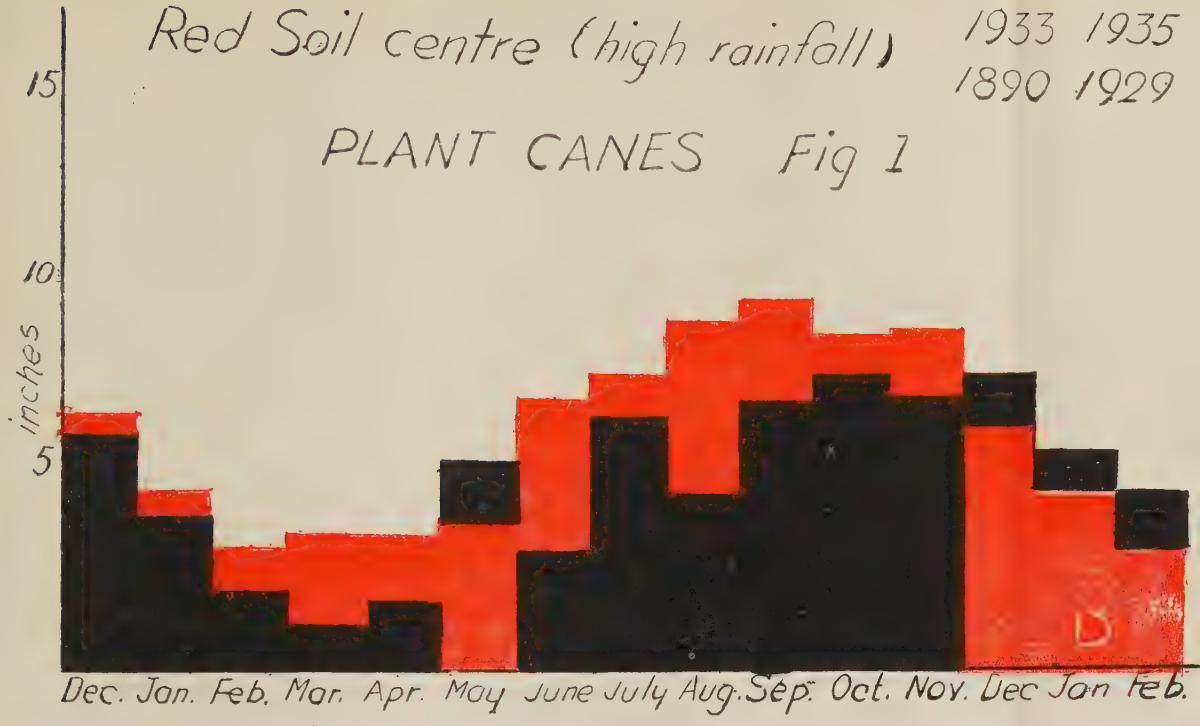
The yield of cane and per cent. sucrose in juice results are treated in this way in Table II and III, where it is also possible to see any interactions between the nitrogenous and potash manuring.

DISTRIBUTION OF RAINFALL.

Red Soil centre (high rainfall)

1933 1935
1890 1929

PLANT CANES Fig I



Black Soil centre (low rainfall)

PLANT CANES Fig II

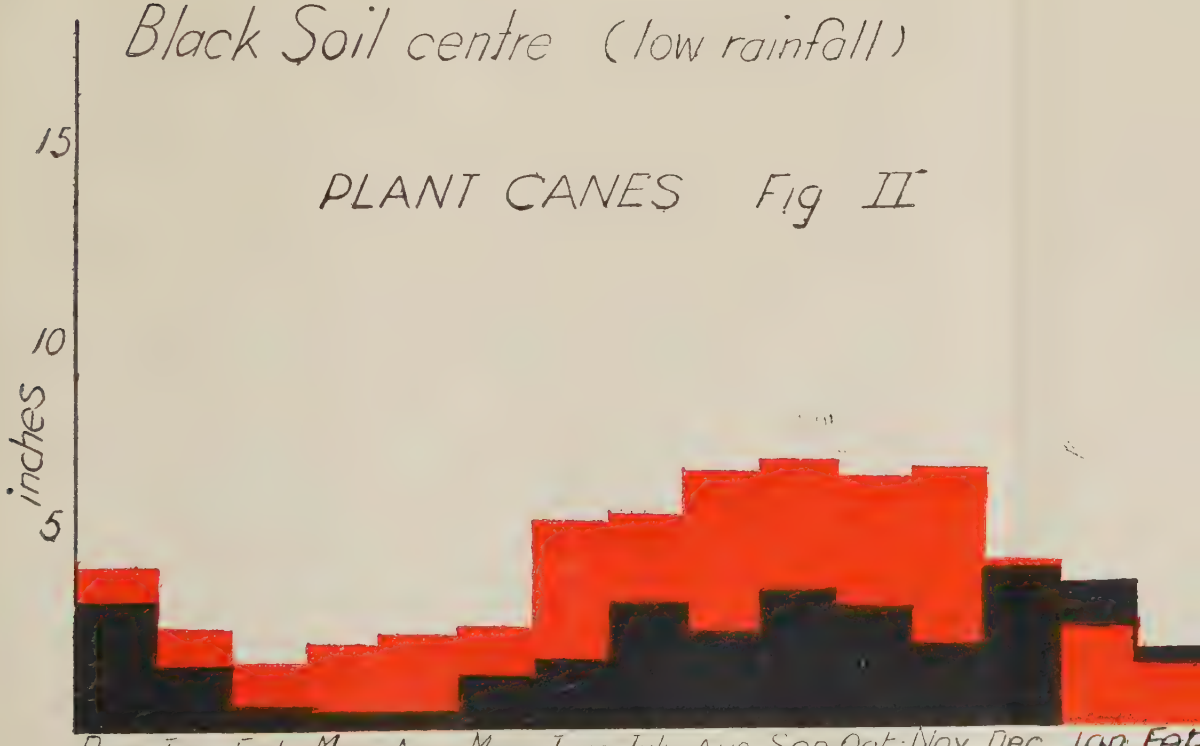


TABLE II.

EFFECT OF VARYING AMOUNTS OF NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE.

Treatment per acre.		Black Soil Centre.				Red Soil Centre.			
lb. N.	lb. K_2O	Yield Tons Cane.	Mean Diff.	Per cent. Sucrose in Juice.	Mean Diff.	Yield Tons Cane.	Mean Diff.	Per cent. Sucrose in Juice.	Mean Diff.
Effect of 60 lb. Nitrogen.									
0	0	14·5		18·20		26·3		18·96	
			−0·2		+0·11		+0·6		−0·3
60	0	14·3		18·31		26·9		18·61	
0	60	14·5		18·06		29·4		18·88	
			−0·1		+0·33		+0·9		+0·23
60	60	14·4		18·49		30·3		19·11	
0	120	15·5		18·26		30·5		19·11	
			−1·2		+0·11		+1·6		+0·39
60	120	14·3		18·37		32·1		19·50	
Differences between means of 18 plots.		−0·50		+0·18		+1·03		+0·09	
Effect of 120 lb. Nitrogen.									
0	0	14·5		18·20		26·3		18·96	
			−0·8		+0·06		+1·4		−0·25
120	0	13·7		18·26		27·7		18·71	
0	60	14·5		18·06		29·4		18·88	
			−0·4		+0·05		−0·6		−0·57
120	60	14·1		18·11		28·8		18·31	
0	120	15·5		18·26		30·5		19·11	
			−2·0		0		+0·7		−0·23
120	120	13·5		18·26		31·2		18·88	
Differences between means of 18 plots.		−1·07		+0·04		+0·50		−0·35	

TABLE III.

EFFECT OF VARYING AMOUNTS OF POTASH ON YIELD AND PER CENT. SUCROSE IN JUICE.

Treatment per acre.		Black Soil Centre.				Red Soil Centre.			
lb. N.	lb. K_2O	Yield Tons Cane.	Mean Diff.	Per cent. Sucrose in Juice.	Mean Diff.	Yield Tons Cane.	Mean Diff.	Per cent. Sucrose in Juice.	Mean Diff.
Effect of 60 lb. Potash									
0	0	14·5	0	18·20	−0·14	26·3	+3·1	18·96	−0·08
0	60	14·5		18·06		29·4		18·88	
60	0	14·3	+0·1	18·31	+0·18	26·9	+3·4	18·61	+0·51
60	60	14·4		18·49		30·3		19·11	
120	0	13·7	+0·4	18·26	−0·15	27·7	+1·1	18·71	−0·40
120	60	14·1		18·11		28·8		18·31	
Differences between means of 18 plots.		+0·17		−0·04		+2·53		+0·01	
Effect of 120 lb. Potash									
0	0	14·5	+1·0	18·20	+0·06	26·3	+4·2	18·96	+0·15
0	120	15·5		18.26		30·5		19·11	
60	0	14·3	0	18·31	+0·06	26·9	+5·2	18·61	+0·89
60	120	14·3		18·37		32·1		19·50	
120	0	13·7	−0·2	18·26	0	27·7	+3·5	18·71	+0·17
120	120	13·5		18·26		31·2		18·88	
Differences between means of 18 plots.		+0·27		+0·04		+4·30		+0·40	

The results given in Tables II and III are summarised in Tables IV and V.

TABLE IV.

EFFECT OF VARYING DOSES OF NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE.

Differences from No Nitrogen Plots. (Means of 18.)

Treatment per acre.	Black Soil Centre.		Red Soil Centre.	
	Yield (Tons per acre.)	% Sucrose in Juice.	Yield (Tons per acre.)	% Sucrose in Juice.
60 lb. Nitrogen	−0·50	+0·18	+1·03	+0·09
120 lb. Nitrogen	−1·07	+0·04	+0·50	−0·35

TABLE V.

EFFECT OF VARYING DOSES OF POTASH ON YIELD AND PER CENT. SUCROSE IN JUICE.

Differences from No Potash Plots. (Means of 18)

Treatment Per Acre.	Black Soil Centre.		Red Soil Centre.	
	Yield (Tons per acre).	Per Cent Sucrose in Juice.	Yield (Tons per acre).	Per Cent Sucrose in Juice.
60 lb. Potash ..	+ 0.17	— 0.04	+ 2.53	+ 0.01
120 lb. Potash ..	+ 0.27	+ 0.04	+ 4.30	+ 0.40

Statistical Analyses of Tables IV and V.

The following differences between the means of 18 *plots have* 20.1 *chances of being due to treatment.*

Black Soil Centre. 1.37 *tons cane;* 0.25% *sucrose in juice.*
Red Soil Centre.. 2.18 *tons cane;* 0.36% *sucrose in juice.*

CONCLUSIONS.

BLACK SOIL CENTRE.

At this centre, the rainfall for the fifteen months growing season was only 32 inches and the lack of water limited the crop to about fourteen tons of cane per acre.

As would be expected, there has been no significant effects on the yield or sucrose in juice of either the nitrogen or potash manures. The plots receiving 60 lb. nitrogen as sulphate of ammonia actually yielded ½ ton of cane less whilst the plots receiving 120 lb. nitrogen as sulphate of ammonia yielded a ton of cane less per acre than the no nitrogen plots. These figures, however, are not significant under the conditions of the experiment, but the indication is that sulphate of ammonia may actually depress the yield of cane under dry conditions.

RED SOIL CENTRE.

At this centre, the rainfall was also below the average, but a total of 72 inches for the growing season was sufficient to produce a fair crop and demonstrate the effects of nitrogen and potash under the conditions at this particular centre.

The additions of nitrogen as sulphate of ammonia had no significant effects on the yield of cane, but the heavier dressing of sulphate of ammonia, i.e. 120 lb. of nitrogen per acre has had a depressing effect on the per cent. sucrose in the juice.

The cane, at this centre, has shown a marked response to potash manuring. 60 lb. potash as muriate of potash has increased the yield by 2½ tons per acre, whilst 120 lb. potash has increased the yield by nearly 4½ tons per acre and has also significantly increased the per cent. sucrose in the juice.

This effect of potash on plant cane in some of the red soil ratooning areas has been noted in earlier trials and has been traced down to lack of potash in the ratoon manure. Cane kept for ratoons should receive about 100 lb. potash per acre, i.e. about 1½ cwts. muriate or 2 cwts. sulphate of potash. The general practice of giving 1 cwt. of nitrate of potash per acre, (i.e. about 47 lbs. potash) to ratoons results in the cane taking more potash from the soil than is supplied in the manure. Analyses of cane carried out over a series of years by the Department show that an average cane crop will remove about 80 lb. potash per acre from the soil.

TYPE II.

This trial was laid down at a black soil centre representative, under average conditions, of a low medium rainfall district.

PLAN.

The trial was put down in the form of four randomised blocks. There were sixteen treatments which were made up of the various combinations of four dif-

ferent applications of nitrogen and potash. The varying amounts of nitrogen and potash applied were 0, 40, 80 and 120 lb. per acre, respectively. The size of each plot was 56 cane holes (approximately 1/30 acre) and the inside 42 holes were cut and weighed in the estimation of yield. For sucrose determinations a representative sample of approximately 100 lb. cane was selected from each plot for analysis making a total of 64 samples.

RAINFALL.

The rainfall for the growing period December 1933—February 1935 measured 50.43 inches as compared with an average of 59 inches for the same months between the years 1890—1929. The distribution of the rainfall for the different months of the year is set out in Fig. III from which it will be seen that although the rainfall is below average, conditions were very much better than at the black soil centre, dealt with in Type I.

YIELD RESULTS.

The yield results in terms of tons of cane and per cent. sucrose in juice for the means of the individual plots are set out in Table VI.

TABLE VI.

Plot No.	Treatment (per acre).		Means of Four Plots.	
	K_2O Lb.	N lb.	Tons Cane	% Sucrose.
1	0	0	20.95	15.89
2	0	40	24.69	16.11
3	0	80	25.86	16.11
4	0	120	27.10	15.74
5	40	0	20.73	16.02
6	40	40	24.12	16.11
7	40	80	26.52	16.11
8	40	120	28.79	15.68
9	80	0	21.15	16.05
10	80	40	25.20	16.36
11	80	80	25.92	16.13
12	80	120	26.60	16.41
13	120	0	19.99	16.05
14	120	40	24.31	16.00
15	120	80	26.83	16.04
16	120	120	25.81	16.37

N = Nitrogen as sulphate of ammonia.
K_2O= Potash as Muriate of Potash.

Statistical Analysis.

A difference between the means of four plots of 3.4 *tons cane or* 0.55% *Sucrose has a* 20.1 *chance of being due to treatment.*

The effects on the yield and the per cent. sucrose in juice are considered separately in Tables VII and VIII, where the differences between the means of sixteen plots are given.

DISTRIBUTION OF RAINFALL

1933-1935

1890-1929

Black Soil centre

PLANT CANES Fig. III

Red Soil centre

RATOONS Fig IV

TABLE VII.

EFFECT OF VARYING AMOUNTS OF NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE.

Treatment Per acre. Lb. N.	Treatment Per acre. Lb. K_2O	Yield Tons Cane.	Difference Between Means of 4 Plots.	Per Cent. Sucrose in Juice.	Difference Between Means of 4 Plots.
EFFECT OF 40 LB. NITROGEN.					
0	0	21.0	+ 3.7	15.89	+ 0.22
40	0	24.7		16.11	
0	40	20.7	+ 3.4	16.02	+ 0.09
40	40	24.1		16.11	
0	80	21.2	+ 4.0	16.05	+ 0.31
40	80	25.2		16.36	
0	120	20.0	+ 4.3	16.05	— 0.05
40	120	24.3		16.00	
Difference Between Means of 16 Plots ..			+ 3.85		+ 0.14
EFFECT OF 80 LB. NITROGEN.					
0	0	21.0	+ 4.9	15.89	+ 0.22
80	0	25.9		16.11	
0	40	20.7	+ 5.8	16.02	+ 0.09
80	40	26.5		16.11	
0	80	21.2	+ 4.7	16.05	+ 0.08
80	80	25.9		16.13	
0	120	20.0	+ 6.8	16.05	— 0.01
80	120	26.8		16.04	
Difference Between Means of 16 Plots ..			+ 5.55		+ 0.09

TABLE VII.—(*Continued*).

Treatment Per acre.		Yield Tons Cane.	Difference Between Means of 4 Plots.	Per Cent. Sucrose in Juice.	Difference Between Means of 4 Plots.
Lb. N.	Lb. K_2O				
EFFECT OF 120 LB. NITROGEN.					
0	0	21.0	+ 6.1	15.89	— 0.15
120	0	27.1		15.74	
0	0	20.7	+ 8.1	16.02	— 0.34
120	40	28.8		15.68	
0	80	21.2	+ 5.4	16.05	+ 0.36
120	80	26.6		16.41	
0	120	20.0	+ 5.8	16.05	+ 0.32
120	120	25.8		16.37	
Difference Between Means of 16 Plots ..			+ 6.35		+ 0.05

TABLE VIII.

EFFECT OF VARYING AMOUNTS OF POTASH ON YIELD AND PER CENT SUCROSE IN JUICE.

Treatment Per acre. Lb. N.	Lb. K_2O	Yield Tons per acre.	Difference Between Means of 4 Plots.	Per Cent. Sucrose in Juice.	Difference Between Means of 4 Plots.
EFFECT OF 40 LB. POTASH.					
0	0	21.0		15.89	
			— 0.3		+ 0.13
0	40	20.7		16.02	
40	0	24.7		16.11	
			— 0.6		0
40	40	24.1		16.11	
80	0	25.9		16.11	
			+ 0.6		0
80	40	26.5		16.11	
120	0	27.1		15.74	
			+ 1.7		— 0.06
120	40	28.8		15.68	
Difference Between Means of 16 Plots ..			+ 0.35		+ 0.02
EFFECT OF 80 LB. POTASH.					
0	0	21.0		15.89	
			+ 0.2		+ 0.16
0	80	21.2		16.05	
40	0	24.8		16.11	
			+ 0.5		+ 0.25
40	80	25.3		16.36	
80	0	25.9		16.11	
			0		+ 0.02
80	80	25.9		16.13	
120	0	27.1		15.74	
			— 0.5		+ 0.67
120	80	26.6		16.41	
Difference Between Means of 16 Plots ..			+ 0.05		+ 0.27

TABLE VIII.—(*Continued*).

EFFECT OF VARYING AMOUNTS OF POTASH ON YIELD AND PER CENT. SUCROSE IN JUICE.

Treatment per acre. Lb. N.	Lb. K_2O	Yield Tons per acre.	Difference Between Means of 4 Plots.	Per Cent. Sucrose in Juice.	Difference Between Means of 4 Plots.
EFFECT OF 120 LB. POTASH.					
0	0	21.0		15.89	
			— 1.0		+ 0.16
0	120	20.0		16.05	
40	0	24.7		16.11	
			— 0.4		— 0.11
40	120	24.3		16.00	
80	0	25.9		16.11	
			+ 0.9		— 0.07
80	120	26.8		16.04	
120	0	27.1		15.74	
			— 1.3		+ 0.63
120	120	25.8		16.37	
Difference Between Means of 16 Plots ..			— 0.45		+ 0.15

TABLE IX.

EFFECT OF VARYING AMOUNTS OF NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE.

Treatment per acre.	Difference from No Nitrogen Plots. (Means of 16).	
	Yield (Tons).	Per Cent. Sucrose.
40 lb. Nitrogen ..	+ 3.85	+ 0.14
80 lb. Nitrogen ..	+ 5.55	+ 0.09
120 lb. Nitrogen ..	+ 6.35	+ 0.05

TABLE X.

EFFECT OF VARYING AMOUNTS OF POTASH ON YIELD AND PER CENT SUCROSE IN JUICE.

Treatment per acre.	Difference from no Potash Plots. (Means of 16).	
	Yield (Tons).	Per Cent. Sucrose.
40 lb. Potash ..	+ 0.35	+ 0.02
80 lb. Potash ..	+ 0.05	+ 0.27
120 lb. Potash ..	+ 0.45	+ 0.15

Statistical Analysis.

A difference between the means of 16 *plots of* 1.72 *tons cane or* 0.28 *per cent. sucrose in juice has a* 20 :1 *chance of being due to treatment.*

CONCLUSIONS.

The effect of nitrogen, as sulphate of ammonia, has been very marked at this centre in increasing the yield of cane although the return diminishes with each additional application of nitrogen. The monetary return for this nitrogenous manuring is shown in Table XI. where it will be seen that, at present prices of cane, the last increment of sulphate of ammonia is not paid for by the increased yield of cane and, further, this increase cannot be regarded as significant under the conditions of the experiment.

TABLE XI.

Treatment.	Increased Yield (Tons)	Value of increase at $3.50 per ton cane.	Value of Sulphate of Ammonia at $37.00 per ton.	Profit or Loss.
			$	$
1st 40 lb. Nitrogen ..	3.85	12.47	3.30	+ 9.17
2nd 40 lb. Nitrogen ..	1.70	5.95	3.30	+ 2.65
3rd 40 lb. Nitrogen ..	0.80	2.80	3.30	— 0.50

The potash manuring has had no significant effect on the yield of cane. It is proposed to continue these plots as ratoons with the same treatments and it will be of interest to find out whether two crops can be grown on this soil without potash manuring.

As indicated in previous trials, increasing doses of nitrogen do not appear to have the same effect in depressing the sucrose in the juice of plant cane as so generally occurs with ratoons. The 80 and 100 lb. dressings of potash have increased the sucrose in the juice, but these increases can scarcely be regarded as significant.

II. RATOONS.

TRIAL I.

MT. WILTON. MASCOLL FIELD. (1932—33; 1933—34; 1934—35).

This trial was a continuation of the experiment on ratoons which have now been manured in the same way for three successive growing seasons. The results of the two previous crops were reported in Vol. II. (1933) p. 12 and Vol. IV (1935) p. 9 of the Barbados Agricultural Journal. The cane reaped this year from these plots were fourth ratoons or fifth crop canes.

RAINFALL.

The rainfall during the growing season April 1934—March 1935 for this centre was 63.05 inches as compared with an average of 75.15 inches for the same months for the years 1890-1929. The distribution of the rainfall, compared with the average is shown in Fig. IV. It will be noted that the rainfall was much below the average between June and November, but the rains between December and February were in excess of the average and the cane made considerable growth during this period.

YIELD RESULTS.

The yields of cane and per cent. sucrose in juice for the three years 1932—33, 1933—34 and 1934—35, together with the manurial treatment are set out in Table XII.

TABLE XII.

(Means of 4).

Treatment per acre.		1932—33.		1933—34		1934—35.	
Lb. N.	lb. K_2O	Tons Cane per acre.	% Sucrose in Juice.	Tons Cane per acre.	% Sucrose in Juice.	Tons Cane per acre.	% Sucrose in Juice.
0	0	36.4	19.83	19.1	21.29	20.1	17.53
40	0	38.1	19.56	19.4	21.18	19.7	17.31
80	0	38.4	19.29	21.3	20.08	23.0	16.96
120	0	40.4	19.30	21.6	19.71	25.9	17.75
0	40	35.3	19.83	17.6	21.00	20.0	17.49
40	40	36.3	19.47	20.0	21.49	24.6	17.77
80	40	36.5	19.43	25.2	20.45	30.4	18.18
120	40	37.5	19.18	23.0	19.92	28.4	17.87
0	80	36.2	19.61	20.7	21.48	21.9	17.77
40	80	37.2	19.58	17.9	21.49	25.3	17.94
80	80	37.7	19.14	20.5	20.87	32.9	18.44
120	80	33.8	19.73	23.4	20.42	35.2	17.98
0	120	34.3	20.01	18.2	21.39	22.8	18.06
40	120	36.4	19.90	19.2	21.54	27.3	18.57
80	120	38.7	19.91	21.2	21.15	29.4	18.51
120	120	38.3	19.12	22.8	20.45	30.6	17.74
Mean of 16 Plots.		37.3	19.56	20.7	20.87	26.1	17.87

The detailed treatment of the results of the second ratoons (1932—33) will be found on pages 12—21 of Vol. 2, No. 4, of this Journal and for the third ratoons (1933—34) on pages 9—16 of Vol. 4, No. 1, of the Journal.

The effects on the yield and sucrose in juice of the different doses of nitrogen or potash for the fourth ratoons (1934—35) are considered in detail in Tables XIII and XIV, where also the differences between the means of sixteen plots for each addition of nitrogen or potash are given.

TABLE XIII.

EFFECT OF VARYING AMOUNTS OF NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE OF FOURTH RATOONS (1934—35).

Treatment per acre.		Yield (Tons Cane).	Difference Between Means of 4 Plots.	Per Cent. Sucrose in Juice.	Difference Between Means of 4 Plots.
Lb. Nitrogen.	lb. Potash.				
EFFECT OF 40 LB. NITROGEN.					
0	0	20.1	— 0.4	17.53	— 0.22
40	0	19.7		17.31	
0	40	20.0	+ 4.6	17.49	+ 0.28
40	40	24.6		17.77	
0	80	21.9	+ 3.4	17.77	+ 0.17
40	80	25.3		17.94	
0	120	22.8	+ 4.5	18.06	+ 0.51
40	120	27.3		18.57	
Difference Between means of 16 plots ..			+ 3.0		+ 0.24

TABLE XIII.—(*Continued*).

EFFECT OF VARYING ACCOUNTS OF NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE OF FOURTH RATOONS (1934—35).

Treatment per acre. Lb. Nitrogen.	Lb. Potash.	Yield (Tons Cane).	Difference Between Means of 4 Plots.	Per Cent. Sucrose in Juice.	Difference Between Means of 4 Plots.
EFFECT OF 80 LB. NITROGEN.					
0	0	20.1	+ 2.9	17.53	— 0.57
80	0	23.0		16.96	
0	40	20.0	+ 10.4	17.49	+ 0.69
80	40	30.4		18.18	
0	80	21.9	+ 11.0	17.77	+ 0.67
80	80	32.9		18.44	
0	120	22.8	+ 6.6	18.06	+ 0.45
80	120	29.4		18.51	
Difference Between means of 16 plots ..			+ 7.7		+ 0.31
EFFECT OF 120 LB. NITROGEN.					
0	0	20.1	+ 5.8	17.53	+ 0.22
120	0	25.9		17.75	
0	40	20.0	+ 8.4	17.49	+ 0.38
120	40	28.4		17.87	
0	80	21.9	+ 13.3	17.77	+ 0.21
120	80	35.2		17.98	
0	120	22.8	+ 7.8	18.06	+ 0.32
120	120	30.6		17.74	
Difference Between means of 16 plots ..			+ 8.8		+ 0.12

TABLE XIV.

EFFECT OF VARYING AMOUNTS OF POTASH ON YIELD AND PER CENT. SUCROSE IN JUICE OF FOURTH RATOONS (1934—35).

Treatment per acre.		Yield (Tons Cane).	Difference Between Means of 4 Plots.	Per Cent. Sucrose in Juice.	Difference Between Means of 4 Plots.
Lb. Nitrogen.	Lb. Potash.				
EFFECT OF 40 LB. POTASH.					
0	0	20.1	— 0.1	17.53	— 0.04
0	40	20.0		17.49	
40	0	19.7	+ 4.9	17.31	+ 0.46
40	40	24.6		17.77	
80	0	23.0	+ 7.4	16.96	+ 1.22
80	40	30.4		18.18	
120	0	25.9	+ 2.5	17.75	+ 0.12
120	40	28.4		17.87	
Difference Between means of 16 plots ..			+ 3.7		+ 0.44
EFFECT OF 80 LB. POTASH.					
0	0	20.1	+ 1.8	17.53	+ 0.24
0	80	21.9		17.77	
40	0	19.7	+ 5.6	17.31	+ 0.63
40	80	25.3		17.94	
80	0	23.0	+ 9.9	16.96	+ 1.48
80	80	32.9		18.44	
120	0	25.9	+ 9.3	17.75	+ 0.23
120	80	35.2		17.98	
Difference Between means of 16 plots ..			+ 6.7		+ 0.65

TABLE XIV.—(*Continued*)

EFFECT OF VARYING AMOUNTS OF POTASH ON YIELD AND PER CENT. SUCROSE IN JUICE OF FOURTH RATOONS (1934-35).

Treatment per acre. Lb. Nitrogen.	Lb. Potash.	Yield (Tons Cane).	Difference Between Means of 4 Plots.	Per Cent. Sucrose in Juice.	Difference Between Means of 4 Plots.
EFFECT OF 120 LB. POTASH.					
0	0	20.1	+ 2.7	17.53	+ 0.53
0	120	22.8		18.06	
40	0	19.7	+ 7.6	17.31	+ 1.26
40	120	27.3		18.57	
80	0	23.0	+ 6.4	16.96	+ 1.55
80	120	29.4		18.51	
120	0	25.9	+ 4.7	17.75	+ 0.01
120	120	30.6		17.74	
Difference Between means Means of 16 Plots ..			+ 5.4		+ 0.84

Statistical Analysis of Tables XIII and XIV.

A difference between the means of 4 plots of 5.2 tons cane or 0.52% sucrose in juice has a 20:1 chance of being due to treatment.

CONCLUSIONS.

(1) YIELD.

It is evident from a study of the figures given in the previous two tables, that the yield of these fourth ratoons has shown responses both to the nitrogenous and potash manuring. The interactions between the nitrogenous and potash manurings are brought out in Tables XV and XVI where the differences in yield between the different potash and nitrogen plots from the no manure plot are shown at the different levels of manuring of the other constituent.

TABLE XV.

DIFFERENCES (TONS) IN YIELD DUE TO 40, 80 AND 120 LB. POTASH AT DIFFERENT LEVELS OF NITROGEN MANURING.

Lb. K_2O per acre	Lb. Nitrogen per acre.			
	0 (N_0)	40 (N_1)	80 (N_2)	120 (N_3)
40	— 0.1	+ 4.9	+ 7.4	+ 2.5
80	+ 1.8	+ 5.6	+ 9.9	+ 9.3
120	+ 2.7	+ 7.6	+ 6.4	+ 4.7
Differences between means of 12 plots	+ 2.2	+ 6.0	+ 7.9	+ 5.5

TABLE XVI.

DIFFERENCES (TONS) IN YIELD DUE TO 40, 80 AND 120 LB. NITROGEN AT DIFFERENT LEVELS OF POTASH MANURING.

Lb. Nitrogen per acre.	Lb. Potash per acre.			
	0 (K_0)	40 (K_1)	80 (K_2)	120 (K_3)
40	— 0.4	+ 4.6	+ 3.4	+ 4.5
80	+ 2.9	+10.4	+11.0	+ 6.6
120	+ 5.8	+ 8.4	+13.3	+ 7.8
Differences between means of 12 plots	+ 2.8	+ 7.8	+ 9.1	+ 6.3

Statistical Analysis of Tables XV and XVI.

A difference between the means of 4 *plots of* 5.2 *tons or between the means of* 12 *plots of* 3.0 *tons has a* 20:1 *chance of being due to treatment.*

The figures in Table XV show that on the plots receiving no nitrogen, the effect of increasing the potash manuring has been to give small increases in the yield, but these increases are not significant. With 40 lb. nitrogen per acre, the increases due to potash manuring are much more pronounced and each of the three successive additions of potash has resulted in a further increase in yield.

With 80 lb. and 120 lb. nitrogen per acre, the yields are greater, as is to be expected, but the maximum increase, in each case, is obtained with the 80 lb. application of potash. (See also Table XVIII.)

Similar conclusions can be drawn from Table XVI. The increasing nitrogenous dressings result in increased yields although the effect of increasing the nitrogen from 80 lb. to 120 lb. is small and not significant. The nitrogenous dressings are only able to exert their maximum effect on the yield when combined with 80 lb. potash per acre. On the no-potash plots, the effects on the yield of increasing applications of nitrogen are small. Although plots receiving 120 lb. potash do not appear to have given as good results as those receiving 80 lb. potash, the differences are not statistically significant.

SUMMARY OF RESULTS FOR THE THREE CROPS.

The effects of the different applications of nitrogen and potash over the three-year period on the yield and per cent. sucrose in juice are shown in Tables XVII and XVIII.

(1) YIELD.

It will be noted that for the first two growing seasons at this centre which is typical of red soils which have been maintained in "good heart", the yield of cane showed no response to potash manuring. In the third year, however, there is a considerable decrease in yield on the plots receiving no potash and those which have received 40 lb. potash per acre. It is therefore evident that the soil reserves of potash had been exhausted by two crops of cane on the no-potash plots and that an annual application of 40 lb. potash per acre has been insufficient to keep up the reserves of this nutrient.

The effect of nitrogenous dressings has also become more evident after two crops and it is evident that 40 lb. nitrogen per acre is insufficient to grow the maximum crop of cane. There is no big difference in yield between the 80 and 120 lb. nitrogen plots.

TABLE XVII.

EFFECT OF VARYING DOSES OF NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE.

Treatment per Acre.	Differences from No-Nitrogen Plots. (Mean of 16)					
	1932—33.		1933—34		1934—35.	
	Yield (Tons Cane).	Per Cent. Sucrose in Juice.	Yield (Tons Cane).	Per Cent. Sucrose in Juice.	Yield (Tons Cane).	Per Cent. Sucrose in Juice.
40 lb. Nitrogen	+ 1.6	— 0.19	+ 0.2	— 0.11	+ 3.0	+ 0.24
80 lb. Nitrogen	+ 2.3	— 0.38	+ 3.1	— 0.65	+ 7.7	+ 0.31
120 lb. Nitrogen	+ 3.2	— 0.63	+ 3.8	— 1.17	+ 8.8	+ 0.12
Mean of No Manure Plots	35.5	19.82	18.9	21.29	21.2	17.71

TABLE XVIII.

EFFECT OF VARYING DOSES OF POTASH ON YIELD AND PER CENT. SUCROSE IN JUICE.

Treatment per Acre.	Differences from No-Potash Plots. (Mean of 16)					
	1932—33.		1933—34		1934—35.	
	Yield (Tons Cane).	Per Cent. Sucrose in Juice.	Yield (Tons Cane).	Per Cent. Sucrose in Juice.	Yield (Tons Cane).	Per Cent. Sucrose in Juice.
40 lb. Potash..	— 1.9	— 0.02	+ 1.1	+ 0.15	+ 3.7	+ 0.44
80 lb. Potash..	— 0.7	— 0.12	+ 0.4	+ 0.50	+ 6.7	+ 0.65
120 lb. Potash..	— 1.4	+ 0.24	0.0	+ 0.57	+ 5.4	+ 0.84
Mean of No Potash Plots	38.4	19.50	20.4	20.56	22.2	17.39

Statistical Analysis of Tables XVII and XVIII.

Difference between the mean yields of 16 *plots of—*
(1) 2.3 *tons cane and % sucrose in juice for* 1932-33,
(2) 1.8 *tons cane and* 0.22% *sucrose in juice for* 1933-34,
(3) 2.6 *tons cane and* 0.26% *sucrose in juice for* 1934-35,
have a 20:1 *chance of being due to treatment.*

2. SUCROSE.

The sucrose figures over the three-year period are of considerable interest since they indicate that the depressing effect of nitrogen on the sucrose content of the juice is related to the degree of maturity of the cane. In 1933–34 the cane ripened early in the crop season, the average per cent. sucrose in the juice of the cane from the no-manure plots was 21.29%. In this season, the depressing action of the nitrogen on the sucrose content of the juice was at its greatest. 120 lb. nitrogen depressed the sucrose content of the juice by 1.17% to 20.12%. During the season 1934–35 when the rains came in very late and continued into the crop season, the cane was immature at reaping and the sucrose in the juice from the no-manure plots was only 17.39%. The juice from the plots receiving nitrogen shows no depression of the sucrose content which would indicate that the cane from all the plots was uniformly unripe and the earlier ripening of the no-nitrogen plots which other trials had led one to expect as a general rule with ratoons on red soils had not, at the time of reaping, shown up. In the 1932–33 season, there is an intermediate year with sucrose in the juice from the no-manure plots of 19.82%. This represents an average degree of ripening and although the cane from the nitrogen plots is seen to be less mature, the differences are not so marked as they were in the 1933–34 season.

(b) Craig Field (1933—34) (1934—35).

This trial was laid down on second ratoons at the same centre as the previous trials and details of the 1933–34 yield of cane and per cent. sucrose in juice results are given on pages 16—22 of Vol. 4, No. 1 of the Barbados Agricultural Journal.

The plots were manured in the same way as third ratoons and the yields and per cent. sucrose in juice for the two years, together with the manurial treatment, are set out in Table XIX.

RAINFALL.

The rainfall data for the growing period 1934–35 at this centre have already been recorded earlier in this section. The distribution of the rainfall is shown in Fig. IV.

TABLE XIX.

Treatment per acre		1933—34 (Means of 4)		1934—35 (Means of 4)	
Lb. Nitrogen as Sulphate of Ammonia.	Lb. Potash as Muriate of Potash.	Tons Cane per acre.	Per Cent Sucrose in Juice.	Tons Cane per acre.	Per Cent Sucrose in Juice.
0	0	22.4	19.66	22.2	17.49
40	0	24.3	19.70	24.1	17.69
80	0	28.4	19.23	27.4	17.04
120	0	30.0	19.12	29.7	17.19
0	40	24.5	19.33	22.3	17.72
40	40	25.1	19.68	27.0	17.56
80	40	29.3	19.61	30.7	17.44
120	40	29.0	18.67	28.0	17.37
0	80	23.0	19.64	22.8	17.62
40	80	25.6	20.00	27.6	17.67
80	80	26.5	19.19	28.4	17.26
120	80	31.8	18.96	31.2	17.51
0	120	23.0	19.69	24.0	17.33
40	120	23.5	20.01	24.4	18.08
80	120	28.2	19.38	30.8	17.99
120	120	30.9	19.30	28.4	17.72

Statistical Analysis.

A difference between the means of 4 *plots of* 4.6 *tons cane or of* 0.71% *sucrose in juice has a* 20.1 *chance of being due to treatment.*

A consideration of the figures given in Table XIX shows that the application of potash manures has had no significant effect on the yield, but that the applications of nitrogen as sulphate of ammonia have had a very marked effect.

In Tables XX and XXI the differences between the means of sixteen plots to illustrate the effect of the different applications of nitrogen and potash on the yield of cane and per cent. sucrose in juice are shown for the two growing seasons.

TABLE XX.

EFFECT OF DIFFERENT APPLICATIONS OF NITROGEN.

Amount per Acre.	Differences from No-Nitrogen Plots. (Means of 16)			
	1933—34		1934—35	
	Yield (Tons per acre).	Per Cent. Sucrose in Juice.	Yield (Tons per acre).	Per Cent. Sucrose in Juice.
40 lb. Nitrogen	+ 1.4	+ 0.27	+ 2.95	+ 0.38
80 lb. Nitrogen	+ 4.9	— 0.23	+ 6.5	+ 0.10
120 lb. Nitrogen	+ 7.2	— 0.57	+ 6.5	+ 0.04
Means of No. Nitrogen Plots ..	23.2	19.58	22.8	17.54

TABLE XXI.

EFFECT OF DIFFERENT APPLICATIONS OF POTASH

Amount per Acre.	Differences from No-Potash Plots. (Means of 4)			
	1933—34		1934—35	
	Yield (Tons per acre).	Per Cent. Sucrose in Juice.	Yield (Tons per acre).	Per Cent. Sucrose in Juice.
40 lb. Potash	+ 0.7	— 0.10	+ 1.2	+ 0.31
80 lb. Potash	+ 0.5	+ 0.02	+ 1.7	+ 0.39
120 lb. Potash	+ 0.1	+ 0.17	+ 1.1	+ 0.59
Means of No. Potash Plots ..	26.3	19.43	25.8	17.35

Statistical Analysis of Tables XX and XXI.

(*a*) *A difference between the mean yields of* 16 *plots of* 2.0 *tons cane for the* 1933—34 *results and* 2.3 *tons cane for the* 1934—35 *results has a* 20:1 *chance of being due to treatment.*

(*b*) *A difference between the mean yield of* 16 *plots of* 0.35% *sucrose in juice for both the* 1933—34 *and* 1934—35 *results has a* 20:1 *chance of being due to treatment.*

CONCLUSIONS.

1. YIELD OF CANES.

In both years, the increasing applications of nitrogen, as sulphate of ammonia, have given large and significant increases in the yield. As shown in other trials, it is evident that 40 lb. nitrogen per acre is insufficient for ratoons; the optimum economic amount to apply with present prices for cane would appear to be between 80 and 100 lb. nitrogen per acre.

The applications of potash have had no significant effects on the yield in either year, but there are indications that the potash reserves of the soil are beginning to run short and it is probable that if this trial were continued for another year, the same effects would be obtained as were noted in the trial previously described in this Section.

2. SUCROSE IN JUICE.

As already noted, the per cent. sucrose in juice was very low during the 1935 crop season denoting an immature cane. The applications of nitrogen have not therefore had their usual depressing effect on the per cent. sucrose in the juice. The juice from the plot receiving 40 lb. nitrogen per acre has a sucrose significantly higher than the juice from the no-nitrogen plots.

The applications of potash have increased significantly the sucrose in the juice as compared with the no-potash plots; this increase is more marked as the potash manuring increases.

SECTION II.

The Effect of Time of Application and Amount of Nitrogen on the Yield and Per Cent. Sucrose in Juice.

I. *Plant Canes.* (1932—34).

The detailed results of this trial on plant canes have already been described in Vol. 4, No. 1, p. 1—8 of this Journal.

II. *Ratoons* (1934—35).

The plant cane at both centres was kept for ratoons and the experiment was continued to investigate the effect of the time of application and the amount of nitrogen as sulphate of ammonia on the yield and per cent. sucrose in the juice of the ratoons.

TREATMENT.

All the plots received a dressing of muriate of potash at the rate of 100 lbs. K_2O per acre in May soon after the plant canes were reaped. Three different amounts of sulphate of ammonia were applied at the rate of 40 lb., 80 lb. and 120 lb. nitrogen per acre. The different times of application of this nitrogen are recorded in Table XXII where the mean yields and per cent. sucrose in juice are also given. The plots were the same as for the plant canes.

PLAN.

It may be noted that the trial was in the form of five randomised blocks and was laid down at (a) a red soil centre with a high rainfall, under average conditions, and (b) a black soil centre with a medium low rainfall, under average conditions.

RAINFALL.

The rainfall for the growing season April, 1934, to March, 1935, was 39.11 inches as compared with an average of 46 inches for the same months between the years 1890—1929. At the red soil centre the rainfall was 45.41 inches as compared with an average of 57½ inches for the same months between 1890—1929.

The distribution of the rainfall at the black soil centre was very similar to that shown in Fig. III, whilst for the red soil centre, Fig IV gives a general idea of the rainfall distribution.

TABLE XXII.

	Treatment per acre.			Mean yields of five plots (per acre..)			
	May.	July.	September	Black Soil Centre		Red Soil Centre.	
lb. K_2O	lb. N.	lb. N.	lb. N.	Tons Cane.	Per cent. Sucrose in Juice.	Tons Cane.	Per cent. Sucrose in Juice.
100	15	25	—	16·0	21·95	28·5	19·46
100	—	40	—	16·8	21·89	28·2	19·24
100	—	20	20	15·6	22·01	27·5	19·47
100	15	65	—	19·9	22·20	32·2	19·76
100	—	80	—	19·2	22·07	30·8	19·59
100	—	40	40	18·3	22·17	32·8	19·19
100	15	105	—	20·9	22·12	32·6	19·53
100	—	120	—	22·9	22·32	33·4	19·29
100	—	60	60	22·5	22·40	33·7	19·56
100	—	—	—	11·7	21·56	22·6	18·87

Statistical Analysis.

(*a*) *A difference between the mean yields of* 5 *plots of* 2.6 *tons cane at the black soil centre or* 4.0 *tons cane at the red soil centre, has a* 20:1 *chance of being due to treatment.*

(*b*) *A difference between the mean per cent. sucrose in juice of* 0.42% *at the black soil centre or* 0.61% *at the red soil centre, has a* 20:1 *chance of being due to treatment.*

EFFECTS OF 40, 80 AND 120 LB. OF NITROGEN AS SULPHATE OF AMMONIA ON PLANT CANE AND RATOONS.

The effects of the different amounts of nitrogen on the yield of the ratoons are considered more accurately in Table XXIII and Table XXIV where the effects of the different times of application are disregarded. The plant cane results obtained in 1934 are also included for the sake of comparison.

TABLE XXIII.

EFFECT OF 40, 80 AND 120 LB. NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE AT BLACK SOIL CENTRE.

Treatment.	Plant Canes (1932-34.)				Ratoons (1934-35.)			
lb. Nitrogen per acre.	Tons Cane (Mean of 15)	Diff. from No. Nitrogen Plot.	Per Cent. Sucrose in Juice (Mean of 15)	Diff. from No Nitrogen Plot.	Tons Cane (Mean of 15)	Diff. from No Nitrogen Plot.	Per Cent. Sucrose in Juice (Mean of 15)	Diff. from No Nitrogen Plot.
0	19·6	–	18·82	–	11·7	–	21·56	–
40	26·8	+ 7·2	19·18	+0·36	16·1	+ 4·4	21·95	+0·39
80	33·3	+13·7	19·32	+0·50	19·1	+ 7·4	22·15	+0·59
120	37·5	+17·9	19·37	+0·55	22·1	+10·4	22·28	+0·72

Statistical Analysis.

(*a*) *A difference between the mean yield of* 15 *plots of* 2.8 *tons cane for the plant cane and* 1.5 *tons cane. for the ratoons has a* 20:1 *chance of being due to treatment.*

(*b*) *A difference between the mean per cent. sucrose in juice of* 15 *plots of* 0.20 *per cent. sucrose for the plant cane and* 0.24% *sucrose for the ratoons has a* 20:1 *chance of being due to treatment.*

TABLE XXIV.

EFFECT OF 40, 80 AND 120 LB. NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE AT RED SOIL CENTRE.

Treatment.	Plant Canes (1932-34)				Ratoons (1934-35.)			
	Tons Cane (Mean of 15)	Diff. from No Nitrogen Plot.	Per Cent. Sucrose in Juice (Mean of 15)	Diff. from No Nitrogen Plot.	Tons Cane (Mean of 15)	Diff. from No Nitrogen Plot.	Per Cent Sucrose in Juice (Mean of 15	Diff. from No Nitrogen Plot.
0	32·1	–	20·36	–	22·6	–	18·87	–
40	33·9	+1·8	20·66	+0·30	28·1	+ 5·5	19·39	+0 52
80	34·9	+2·8	20·43	+0·07	31·9	+ 9·3	19·51	+0·64
120	34·9	+2·8	20·48	+0·12	33·2	+10·6	19·46	+0·59

Statistical Analysis.

(*a*) *A difference between the mean yields of* 15 *plots of* 1.8 *tons cane for the plant cane and* 2.3 *tons cane for the ratoons has a* 20:1 *chance of being due to treatment.*

(*b*) *A difference between the mean per cent. sucrose in juice of* 15 *plots of* 0.33% *sucrose for the plant cane and* 0.35% *sucrose for the ratoons has a* 20:1 *chance of being due to treatment.*

CONCLUSIONS.

BLACK SOIL CENTRE.

The successive additions of nitrogen, as sulphate of ammonia, have had very marked effects in increasing the yield of both the plant cane and the subsequent ratoons. On the no-nitrogen plot the ratoons only yielded 11.7 tons cane; this was increased by 4.4 tons with the first 40 lb. nitrogen; by 3.0 tons with the second 40 lb. nitrogen and by a further 3.0 tons with the third 40 lb. nitrogen. At this centre, each additional application of nitrogen proved a profitable investment.

The plots treated with nitrogen also show significant and successive increases of sucrose in the juice. This fact was also noted with the plant canes and indicate that the various factors controlling the effect of nitrogenous manuring on the sucrose in the juice are not yet completely elucidated.

RED SOIL CENTRE.

As plant cane, the successive additions of nitrogen had little effect on the yield but, as ratoons, the effects of the nitrogenous manuring are very marked. The first 40 lb. nitrogen has increased the yield by 5.5 tons cane; the second 40 lb. nitrogen has given a further increase of 3.8 tons and the third 40 lb. nitrogen has resulted in a further increase of 1.3 tons cane which, however, cannot be regarded as significant under the conditions of the experiment.

The plots manured with sulphate of ammonia have all yielded cane giving juice which shows a significant increase in the per cent. sucrose over the cane from the no-nitrogen plots.

THE EFFECTS OF DIFFERENT TIMES OF APPLICATION OF NITROGEN AS SULPHATE OF AMMONIA.

As already noted, the nitrogen was applied to the ratoons in three different ways (a) 15 lb. in May and the remainder in July, (b) all in July as one application, and (c) half in July and half in September. The yield results are set out for the two centres in terms of tons of cane and per cent. sucrose in juice in Tables XXV and XXVI.

TABLE XXV.

EFFECT OF DIFFERENT TIMES OF APPLICATION OF NITROGEN ON YIELD AND PER CENT. SUCROSE IN JUICE OF RATOONS.

BLACK SOIL CENTRE.

Treatment.	May and July.		July.		July and September.	
Lb. N per acre.	Tons Cane. (Mean of 5).	Per Cent. Sucrose in Juice. (Mean of 5).	Tons Cane. (Mean of 5).	Per Cent. Sucrose in Juice. (Mean of 5).	Tons Cane. (Mean of 5).	Per Cent. Sucrose in Juice. (Mean of 5).
40	16.0	21.95	16.8	21.89	15.6	22.01
80	19.9	22.20	19.2	22.07	18.3	22.17
120	20.9	22.12	22.9	22.32	22.5	22.40
Mean of 15 plots	18.9	22.09	19.6	22.09	18.8	22.19

Statistical Analysis.

A difference between the means of 15 *plots of* 1.5 *tons cane or* 0.24% *sucrose in juice has a* 20:1 *chance of being due to treatment.*

TABLE XXVI.

RED SOIL CENTRE.

Treatment.	May and July.		July.		July and September.	
Lb. N per acre.	Tons Cane. (Mean of 5).	Per Cent. Sucrose in Juice. (Mean of 5).	Tons Cane. (Mean of 5).	Per Cent. Sucrose in Juice. (Mean of 5).	Tons Cane (Mean of 5).	Per Cent. Sucrose in Juice. (Mean of 5).
40	28.5	19.46	28.2	19.24	27.5	19.47
80	32.2	19.76	30.8	19.59	32.8	19.19
120	32.6	19.53	33.4	19.29	33.7	19.56
Mean of 15 plots	31.1	19.58	30.8	19.37	31.3	19.41

Statistical Analysis.

A difference between the mean of 15 *plots of* 2.3 *tons cane or* 0.35 *per cent. sucrose in juice, has a* 20:1 *chance of being due to treatment.*

CONCLUSIONS.

It is evident from a consideration of the figures given in Tables XXV and XXVI that the time of application of the sulphate of ammonia has had no significant effects, at either centre, on the yield of cane or on the per cent. sucrose in the juice.

In the case of the plant cane, at the black soil centre, reaped in the previous year, it will be remembered that there was a considerable drop in yield on those plots where the nitrogen was applied half in July and half in September.

SECTION III.

The Effect of Phosphoric Acid on the Yield and Per Cent. Sucrose in the Juice.

PLANT CANES (1932—34).

Particulars of this experiment together with the yield of cane and per cent. sucrose in juice for the plant cane were given in Vol. 4, No. 1 of the Barbados Agricultural Journal on pages 23—24.

RATOONS (1934—35).

The experiment was continued on the ratoons and the plots were manured in the same way as the plant cane.

TREATMENT.

The trial was laid out after the AB BA method of Student with ten replicates for the phosphate and no-phosphate plots, respectively.

The size of each plot was 3 x 20 cane holes and the inside 20 holes were cut and weighed in the estimation of yield. A representative sample of cane weighing approximately 100 lb. was selected at random from each plot for analysis.

All plots received muriate of potash at the rate of 100 lb. potash per acre.

The A plots received no phosphate whilst the B plots received superphosphate at the rate of 450 lb. per acre equivalent to 72 lb. phosphoric acid.

The twenty plots were divided into two blocks of ten plots (5 A and 5 B). Block I received sulphate of ammonia at the rate of 2 cwts. per acre whilst Block II received sulphate of ammonia at the rate of 4 cwts. per acre.

RAINFALL.

The rainfall was similar to that given in Section I, under Mt. Wilton; the distribution of which is given in Fig. V.

The yield and per cent. sucrose in juice of the different plots is set out in Table XXVII.

TABLE XXVII.

BLOCK I. (2 CWTS. SULPHATE OF AMMONIA PER ACRE.)

Plot No.	No. P_2O_5		Plot No.	72 lb. P_2O_5 per acre.	
	Yield (tons)	Per Cent. Sucrose in Juice.		Yield (tons)	Per Cent. Sucrose in Juice.
A 1	35.3	17.38	B 1	31.8	16.15
A 2	30.1	17.55	B 2	36.8	16.84
A 3	33.2	17.55	B 3	32.6	17.72
A 4	32.8	17.55	B 4	30.8	17.46
A 5	30.9	18.33	B 5	35.2	18.77
Mean	32.5	17.67		33.4	17.39

BLOCK II. (4 CWTS. SULPHATE OF AMMONIA PER ACRE.)

Plot No.	No. P_2O_5		Plot No.	72 lb. P_2O_5 per acre.	
	Yield (Tons)	Per Cent. Sucrose in Juice.		Yield (Tons)	Per Cent. Sucrose in Juice.
A 1	39.8	16.76	B 1	35.5	18.33
A 2	39.1	16.76	B 2	30.3	17.09
A 3	27.7	16.84	B 3	29.2	17.20
A 4	43.6	17.11	B 4	37.5	16.77
A 5	38.7	17.02	B 5	44.8	17.09
Mean	37.8	16.90		35.5	17.30

EFFECT OF PHOSPHORIC ACID.

The effect of the addition of 72 lb. phosphoric acid on the mean yield and per cent. sucrose in the juice of the plant canes and ratoons is given in Table XXVIII.

TABLE XXVIII.

EFFECT OF PHOSPHORIC ACID.

Treatment per acre	Plant Canes (1932—34). (Mean of 10)		Ratoons (1934—35). (Mean of 10)	
	Yield (Tons)	Per Cent. Sucrose in Juice.	Yield (Tons)	Per Cent. Sucrose in Juice.
72 lb. P_2O_5	39.24	16.36	34.45	17.35
No. P_2O_5	39.03	16.60	35.11	17.29
Difference	+ 0.21	— 0.24	— 0.66	+ 0.06

Statistical Analysis.

(*a*) *A difference in the mean yields of* 10 *plots of* 2.6 *tons for plant canes and* 3.1 *tons for ratoons, has a* 20:1 *chance of being due to treatment.*

(*b*) *A difference in the mean per cent. sucrose in juice of* 10 *plots of* 0.50% *for plant canes and of* 0.44% *for ratoons has a* 20:1 *chance of being due to treatment.*

CONCLUSIONS.

It is evident from the results given in Table XXVIII that the addition of phosphoric acid to the general artificial manuring of plant canes and ratoons has had no significant effects on either the yield or per cent. sucrose in juice.

EFFECT OF DIFFERENT AMOUNTS OF NITROGEN.

The effect of the two applications of sulphate of ammonia, equivalent to 45 lb. nitrogen and 90 lb. nitrogen per acre respectively, on the yield and per cent. sucrose in juice are set out in Table XXIX.

TABLE XXIX.

EFFECT OF 45 LB. AND 90 LB. NITROGEN PER ACRE AS SULPHATE OF AMMONIA.

Treatment per acre	Plant Canes (1932—34). (Mean of 10)		Ratoons (1934—35). (Mean of 10)	
	Yield (Tons)	Per Cent. Sucrose in Juice.	Yield (Tons)	Per Cent. Sucrose in Juice.
90 lb. Nitrogen	38.50	16.36	36.62	17.10
45 lb. Nitrogen	39.77	16.60	32.94	17.53
Difference	— 1.27	— 0.24	3.68	— 0.43

Statistical Analysis.

(*a*) *A difference in the mean yields of* 10 *plots of* 2.6 *tons for plant canes and* 3.1 *tons for ratoons, has a* 20:1 *chance of being due to treatment.*

(*b*) *A difference in the mean per cent. sucrose in juice of* 10 *plots of* 0.50% *for plant canes and* 0.44% *for ratoons has a* 20:1 *chance of being due to treatment.*

CONCLUSIONS.

For plant canes, there was no significant difference between the yields and per cent. sucrose in juice of the canes manured with 90 lb. or 45 lb. nitrogen per acre as sulphate of ammonia.

For ratoons, the canes manured with 90 lb. nitrogen per acre, outyielded those manured with 45 lb. nitrogen per acre by about 3½ tons which is significant. The juice from the canes receiving the higher dosage of nitrogen contains 0.43% less sucrose which can be judged as significant under the conditions of the experiment.

SUGAR CANE.

A SUMMARY OF PLANTATION VARIETY YIELD RETURNS FOR SEASON 1933—35.

By A. E. S. McINTOSH, Geneticist.

INTRODUCTION.

Plantation variety crop yields are obtained in order to compare the effect of season and variety on plant cane and ratoon tonnages. Moreover, in any one season, they serve to show how the various varieties respond in yield to different rainfall conditions.

The data serve as a check on the variety planting recommendations issued by the Department of Science and Agriculture. These are based on the result of select seedling and variety trials carried out over a range of conditions in the island.

Rainfall During the Season under Review—1933–35. The season under review was one of exceptionally low rainfall. The average total rainfall for the year 1934 from 150 stations was 39.70 inches, being 20.52 inches below the average for the eighty-seven years ended December 31st, 1933.

The rainfall distribution during 1934 and up to the beginning of crop in February, 1935, is shown below and is compared with the average.

RAINFALL—INCHES.

Month	Average	1934–35
January	3.00	3.09
February	2.50	1.09
March	2.20	0.58
April	2.00	0.83
May	3.20	3.09
June	6.00	1.72
July	6.50	4.03
August	7.00	3.90
September	7.50	5.99
October	8.50	4.87
November	8.00	4.61
December	4.00	5.90
January	3.00	4.19
February	2.50	2.33

For the season under review, it can be seen that the dry season was prolonged to the end of June and was unusually severe. Rainfall during the early rainy season months (July—September) was well below average and certainly insufficient to promote good uninterrupted growth. October and November, which are as a rule high rainfall months, experienced low rains and the crop, at this time, looked very poor. Fortunately, the December and January rains were above average and the crop made unusually good growth late in the season.

General Remarks on Growth during the Season. The distribution of the rainfall was very unfavourable to plant cane growth and comparatively favourable to ratoons. This is shown in Table I, where it is seen that ratoons yielded as well as if not better than plant canes.

As a result of the late growing season juice maturation was delayed particularly in varieties with a prolonged growing season such as B.H.(10)12. Rotting and drying out of cane were little in evidence.

The Yield Data. Yield returns were received from one hundred and fifty-five plantations. Each plantation return recorded the field, its acreage, variety grown, whether plant cane or ratoon and the total yield. From these figures, the total acreage and yield of plant cane and ratoon per acre of each variety were determined. The total acreage whose yields were submitted and the average yield per acre of all varieties and crops were ascertained.

These figures are presented in Table I. The general average yield per acre —24.08 tons—may be considered very good under the low rainfall conditions experienced.

A feature of note is the comparatively high yield of ratoon crops in all varieties.

Comparison of Variety Yields. In order to compare variety yields, the plantations were grouped into rainfall categories, thus:—

Category	A.	—	Rainfall	during	1934	— 23″—34″.
,,	B.	—	,,	,,	,,	— 35″—42″.
,,	C.	—	,,	,,	,,	— 43″—50″.
,,	D.	—	,,	,,	,,	— 51″—62″.

Varietal comparisons were then made *within* categories only.

The mean yield per acre of plant cane or ratoon of any variety on any one plantation was taken as the unit. The mean yields per acre, plant cane or ratoon, of two varieties on any one plantation were regarded as a comparable pair. Within any one category these comparable pairs were grouped.

A minimum of three comparable pairs is presented in Table II.

For purposes of statistical enquiry a minimum of eight comparable pairs was considered necessary. The standard error of the mean difference (S.E. diff.) between comparable pairs of each group was determined. The mean difference in yield between any two varieties compared was regarded as statistically significant, if it exceeded its own standard error by two or more.

The comparison of variety plant cane and ratoon yields in each of the rainfall categories is presented in Table II. Under the head—Statistical Significance, a plus sign denotes a significant difference between variety yields, a negative sign denotes that the difference cannot be regarded as statistically significant.

The variety yields are considered here.

Category A. The rainfall in this category was extremely low. Under these conditions, and with regard to plant canes, B.2935 outyielded all other varieties, Ba.11569 was slightly better than B.726, while Ba.11569 yielded better than B.891. There is little difference between B.726 and B.891.

As first ratoons, B.2935 significantly outyielded B.726, while there was little difference between B.2935 and Ba.11569. Ba.11569 gave a slightly better yield than B.726 and an appreciably better yield than B.891.

Category B. The rainfall here may be regarded as low. B.2935, in plant cane crops, outyielded B.726, B.891, B.H.10(12) and Ba.11569, although the difference of 1.33 tons per acre over Ba.11569 cannot be regarded as significant. Ba.11569 outyielded B.726 and B.891 although its yield of 1.78 tons per acre more than B.726 is not significant. B.726, B.H.10(12) and B.891 gave approximately similar yields.

As ratoons, B.2935 outyielded B.726, B.H.10(12) and B.891. Ba.11569 was slightly better than B.2935. B.726 yielded approximately the same as B.H.10(12), and gave a significantly better yield than B.891. Ba.11569 significantly outyielded B.726. Ba.11569 yielded approximately the same as B.H.10(12) but appreciably outyielded B.891. B.H.10(12) gave significantly better yields than B.891.

Category C. The rainfall in this category was reasonably good.

In plant cane crops, B.726 gave higher yields than Ba.11569 and B.891, and less, although not significantly so, than B.H.10(12). B.H.10(12) yielded better than Ba.11569 and B.891.

As ratoons, B.726 yielded approximately the same as B.H.10(12), less, although not significantly less, than Ba.11569 and appreciably more than B.891. B.H.10(12) yielded significantly better than B.891 and slightly less than Ba.11569.

Category D. The rainfall here was good. Two varieties only are compared as plant canes and ratoons—B.726 and B.H.10(12). It is seen that they yielded approximately alike in both crops.

Comments on Variety Comparisons. In the lower rainfall areas the varieties B.2935, Ba.11569 and B.726 are grown almost to the exclusion of other varieties. B.726 requires more moisture than the other varieties noted and on this account in these areas is grown on better fields and in the rainier areas of any one plantation. It serves as an early reaping variety, since both B.2935 and Ba.11569 are later in maturing.

This early ripening feature compensates for its lesser tonnage and justifies its use in these districts.

The figures show that B.2935 outyields Ba.11569 as plant canes in the lower rainfall areas (Categories A and B.) There is little difference between them in ratoon tonnages. Since B.2935 is at least as good a sugar-yielding variety as Ba.11569 and also possesses considerable resistance to gumming disease, it is to be preferred as the standard variety in the lower rainfall areas.

In the higher rainfall areas (Categories C and D) B.726 and B.H.10(12) predominate. Both are better sugar-yielding varieties than Ba.11569 and as the figures show, give as great or even greater tonnages than Ba.11569. In addition, both are commercially resistant to gumming disease. It would appear to be disadvantageous to grow Ba.11569 in these areas.

A comparison between B.726 and B.H.10(12) is of interest. B.726 is an early maturing variety, B.H.10(12) is late maturing. The tonnages recorded show them to yield approximately alike as plant canes and ratoons. Thus from a field and factory point of view they provide an excellent combination for the higher rainfall districts.

Throughout all categories B.891 is inferior. This variety is no longer recommended.

In conclusion, it may be noted that the plantation variety yield returns appear to support the conclusions derived from experiments conducted by the Department of Science and Agriculture and the variety planting recommendations issued thereby.

These recommendations for season 1935–37 were made on the following general scheme.

Under *A*, the varieties are listed in order of importance so far as percentage of the planted acreage is concerned, under *B*, they are listed in order of suggested reaping. Ba.11569 is retained in the low rainfall district, until it is definitely ascertained that B.2935 ratoons satisfactorily there.

District.	A.	B.
High rainfall ..	B.H.10(12), B.726	B.726, B.H.10(12)
Intermediate—high rainfall ..	B.H.10(12) } equal B.726 }	B.726, B.H.10(12)
Intermediate—rainfall ..	B.726, B.2935	B.726, B.2935
Intermediate—low rainfall ..	B.2935, B.726	B.726, B.2935
Low rainfall ..	B.2935, B.726 Ba.11569	B.726, Ba.11569, B.2935.

TABLE I.

SUGAR CANE CROP, 1933—35.

Summary of Plantation Yield Returns.

Variety.		Total acres.	Average in tons per acre.
B.H.10(12)	Plant Canes ..	1,167.81	29.73
,,	1st Ratoons ..	1,099.02	28.86
,,	2nd ,, ..	556.00	27.92
,,	3rd ,, ..	114.00	28.84
,,	4th ,, ..	52.50	28.24
B.2935	Plant Canes ..	1,488.03	23.20
,,	1st Ratoons ..	114.73	23.08
,,	2nd ,, ..	2.25	27.40
Ba.11569	Plant Canes ..	787.27	18.92
,,	1st Ratoons ..	608.05	21.88
,,	2nd ,, ..	9.50	22.82
,,	3rd ,, ..	11.00	28.86
B.726	Plant Canes ..	2,758.95	23.06
,,	1st Ratoons ..	1,601.87	23.19
,,	2nd ,, ..	307.50	26.63
,,	3rd ,, ..	65.75	29.34
,,	4th ,, ..	4.50	24.62
B.891	Plant Canes ..	315.51	19.93
,,	1st Ratoons ..	232.45	19.14
,,	2nd ,, ..	79.25	21.98
B.417	Plant Canes ..	100.75	16.69
B.374	Plant Canes ..	36.25	15.08
,,	1st Ratoons ..	18.00	15.25
Miscellaneous	Plant Canes ..	272.28	20.29
,,	1st Ratoons ..	161.28	23.39
,,	2nd ,, ..	25.25	30.48
		11,989.75	24.08

TABLE II.

ESTATE VARIETY YIELD RETURNS. COMPARISON OF VARIETIES WITHIN RAINFALL CATEGORIES.

CATEGORY A.

Rainfall 23"—34". Number of Estates Submitting Returns—48.

(a) PLANT CANES.

Comparison	No. of estates	Yields – tons per acre	Diff. in favour of— (tons per acre)	S.E. diff.	Statistical significance
B.2935 v B.726 ..	22	20.10 — 17.18	B.2935 —2.92	± 0.62	+
B.2935 v Ba.11569 ..	20	18.82 — 16.35	B.2935 —2.47	± 0.49	+
B.2935 v B.891 ..	6	20.19 — 16.05	B.2935 —4.14	..	..
Ba.11569 v B.726 ..	21	17.38 — 15.87	Ba.11569-1.51	± 0.52	+
B.726 v B.891 ..	7	15.68 — 15.63	B.726 —0.05	..	..
Ba.11569 v B.891 ..	6	16.97 — 14.55	Ba.11569-2.42	..	..

(b) FIRST RATOONS.

B.2935 v B.726 ..	5	18.37 — 14.29	B.2935 —4.08	..	..
B.2935 v Ba.11569 ..	3	18.87 — 19.13	Ba.11569-0.26	..	..
Ba.11569 v B.726 ..	11	19.29 — 18.02	Ba.11569-1.27	± 0.59	+
B.726 v B.891 ..	3	18.05 — 15.88	B.726 —2.17	..	..
Ba.11569 v B.891 ..	4	19.65 — 15.40	Ba.11569-4.25	..	..

TABLE II (CONTINUED).

CATEGORY B.

Rainfall 35"—42". Number of Estates Submitting Returns—63.

(a) PLANT CANES.

Comparison	No. of estates	Yields – tons per acre	Diff. in favour of—(tons per acre)	S.E. diff.	Statistical significance
B.2935 v B.726 ..	29	25.52 — 22.65	B.2935 —2.87	± 0.61	+
B.2935 v Ba.11569 ..	12	23.15 — 21.82	B.2935 —1.33	± 1.03	—
B.2935 v B.H.10(12)	6	26.26 — 22.58	B.2935 —3.68	..	..
B.2935 v B.891 ..	17	25.82 — 21.40	B.2935 —4.42	± 0.98	+
B.726 v Ba.11569 ..	11	20.48 — 22.26	Ba.11569-1.78	± 1.20	—
B.726 v B.H.10(12) ..	11	23.12 — 23.21	B.H.10(12) —0.09	± 0.52	—
B.726 v B.891 ..	17	22.63 — 21.48	B.726 —1.15	± 0.76	—
Ba.11569 v B.891 ..	7	21.29 — 19.16	Ba.11569-2.23	..	..
B.H.10(12) v B.891..	5	22.84 — 22.52	B.H.10(12) —0.32	..	..

(b) FIRST RATOONS.

B.2935 v B.726 ..	12	23.68 — 21.65	B.2935 —2.03	± 0.92	+
B.2935 v Ba.11569 ..	5	21.47 — 22.32	Ba.11569-0.85	..	..
B.2935 v B.H.10(12)	4	23.06 — 21.76	B.2935 —1.30	..	..
B.2935 v B.891 ..	7	22.20 — 17.83	B.2935 —4.37	..	..
B.726 v Ba.11569 ..	13	21.10 — 23.34	Ba.11569-2.24	± 0.68	+
B.726 v B.H.10(12) ..	19	24.42 — 24.22	B.726 —0.20	± 0.72	—
Ba.11569 v B.H. 10(12)	5	23.40 — 22.67	Ba.11569-0.73	..	..
B.726 v B.891 ..	17	22.78 — 19.82	B.726 —2.96	± 0.66	+
Ba.11569 v B.891 ..	8	23.95 — 19.54	Ba.11569-4.41	± 0.80	+
B.H.10(12) v B.891..	11	24.57 — 20.88	B.H.10(12) —3.69	± 1.12	+

CATEGORY C.

Rainfall 43″—50″. Number of Estates Submitting Returns—29.

(a) PLANT CANES.

Comparison	No. of estates	Yields – tons per acre	Diff. in favour of— (tons per acre)	S.E. diff.	Statistical significance
B.726 v Ba.11569 ..	4	30.29 — 26.86	B.726 —3.43	..	..
B.726 v B.H.10(12) ..	14	30.26 — 31.33	B.H.10(12) —1.07	± 0.85	—
B.726 v B.891 ..	3	28.68 — 23.23	B.726 —5.45	..	..
Ba.11569 v B.H. 10(12)	4	26.86 — 30.36	B.H.10(12) —3.50	..	..
B.H.10(12) v B.891 ..	3	29.93 — 23.23	B.H.10(12) —6.70	..	..
(b) RATOONS.					
B.726 v Ba.11569 ..	8	26.48 — 28.34	Ba.11569 —1.86	± 1.11	—
B.726 v B.H.10(12) ..	22	28.87 — 28.55	B.726 —0.32	± 0.72	—
B.726 v B.891 ..	7	26.03 — 20.81	B.726 —5.22	..	..
Ba.11569 v B.H. 10(12)	7	28.80 — 27.15	Ba.11569 —1.65	..	..
B.H.10(12) v B.891 ..	8	25.14 — 21.44	B.H.10(12) —3.70	± 1.12	+

CATEGORY D.

Rainfall 51″—62″. Number of Estates Submitting Returns—15.

(a) PLANT CANES.

Comparison	No. of estates	Yields – tons per acre	Diff. in favour of— (tons per acre)	S.E. diff.	Statistical significance
B.726 v B.H.10(12) ..	8	31.90 — 31.57	B.726 —0.33	± 1.15	—
(b) RATOONS.					
B.726 v B.H.10(12) ..	12	28.41 — 28.45	B.H.10(12) —0.04	± 1.21	—

JUICE ANALYSES IN RELATION TO THE FERTILIZER REQUIREMENTS OF BARBADOS SOILS.

S. J. SAINT, M.Sc., Ph.D., F.I.C.

The data upon which this paper is based were obtained during the crop seasons of 1928, 1929 and 1930. The cane juices, the analyses of which are here recorded, were obtained from selected varieties of sugar cane grown on the variety trial plots at the various stations situated in different areas of Barbados.

The cane used in these investigations was crushed in the experimental three roller mill which gave approximately 70 per cent. by weight of juice and 30 per cent. by weight of megass.

For purposes of record it may be noted that:—

(a) The percentage of ash was determined by gentle ignition at a dull red heat.

(b) The nitrogen was determined by the Kjeldahl method.

(c) The phosphoric acid was determined in the ash by the volumetric ammonium molybdate method.

(d) The potash was determined in the ash by the volumetric cobaltinitrite method.

(1) THE DISTRIBUTION OF NITROGEN, ASH, POTASH AND PHOSPHATE BETWEEN JUICE AND MEGASS.

In order to find the relative distribution of various constituents between megass and juice and to determine whether the analysis of the juice gave a sufficiently accurate estimate of the analysis of the cane as a whole, a series of analyses were made of the juice and megass.

(a) *The Relative Distribution of Constituents between Juice and Megass.*

Juice and megass analyses were carried out on seventy-eight samples of cane in 1929 and also in 1930, which represented three different varieties, viz., Ba.11569, B.381 and B.417 grown at twenty-six different variety trial stations.

The mean analyses of each variety for each year, are set out in Tables I—IV in order to show the distribution for different varieties and different years.

TABLE I.—DISTRIBUTION OF POTASH.

Year.	Variety.	Grams K_2O in 100 Grams Cane (Means of 26)			K_2O in Juice. Per Cent. K_2O in Cane.	K_2O in Megass Per Cent. K_2O in Cane.
		In Juice	In Megass.	In Cane.		
1929 ..	Ba.11569	0.0517	0.0338	0.0855	60.46	39.54
	B.381 ..	0.0494	0.0332	0.0826	59.80	40.20
	B.417 ..	0.0670	0.0357	0.1027	65.24	34.76
	Mean ..	0.0560	0.0342	0.0902	61.84	38.16
1930 ..	Ba.11569	0.0583	0.0355	0.0938	62.15	37.85
	B.381 ..	0.0609	0.0388	0.0997	61.08	38.92
	B.417 ..	0.0757	0.0483	0.1240	61.05	38.95
	Mean ..	0.0650	0.0409	0.1059	61.43	38.57

TABLE II. DISTRIBUTION OF PHOSPHORIC ACID.

Year.	Variety.	Grams P_2O_5 in 100 Grams Cane. (Means of 26).			P_2O_5 in Juice. Per Cent. P_2O_5 in Cane.	P_2O_5 In Megass. Per Cent. P_2O_5 in Cane.
		In Juice	In Megass.	In Cane.		
1929 ..	Ba.11569	.0101	.0098	.0199	50.75	49.25
	B.381 ..	.0101	.0105	.0206	49.04	50.96
	B.417 ..	.0114	.0105	.0219	52.06	47.94
	Mean ..	.0105	.0103	.0208	50.47	49.53
1930 ..	Ba.11569	.0277	.0203	.0480	57.72	42.28
	B.381 ..	.0292	.0201	.0493	59.23	40.77
	B.417 ..	.0287	.0258	.0545	52.66	47.34
	Mean ..	.0285	.0221	.0506	56.32	43.68

TABLE III. DISTRIBUTION OF TOTAL ASH.

Year.	Variety.	Grams Total Ash per 100 Grams of Cane.			Ash in Juice. Per Cent Ash in Cane.	Ash in Megass. Per Cent. Ash in Cane.
		in Juice.	In Megass	In Cane.		
1929 ..	Ba.11569	0.1679	0.2607	0.4286	39.18	60.82
	B.381 ..	0.1771	0.2493	0.4264	41.53	58.47
	B.417 ..	0.2091	0.2408	0.4503	46.44	53.46
	Mean ..	0.1847	0.2503	0.4350	42.46	57.54
1930 ..	Ba.11569	0.1655	0.2600	0.4255	38.90	61.10
	B.381 ..	0.1697	0.2383	0.4080	41.59	58.41
	B.417 ..	0.2046	0.2753	0.4799	42.65	57.35
	Mean ..	0.1799	0.2579	0.4378	41.09	58.91

TABLE IV. DISTRIBUTION OF NITROGEN.

Year.	Variety.	Grams N. in 100 Grams Cane.			N. in Juice Per Cent. N. in Cane.	N in Megass. Per Cent. N. in Cane.
		In Juice	In Megass	In Cane.		
1929 ..	Ba.11569	0.0243	0.0355	0.0598	40.65	59.35
	B.381 ..	0.0205	0.0359	0.0564	36.35	63.65
	B.417 ..	0.0232	0.0319	0.0551	42.10	57.90
	Mean ..	0.0227	0.0344	0.0571	39.76	60.24
1930 ..	Ba.11569	0.0275	0.0414	0.0689	39.91	60.09
	B.381 ..	0.0224	0.0346	0.0570	39.31	60.69
	B.417 ..	0.0261	0.0403	0.0664	39.31	60.69
	Mean ..	0.0253	0.0388	0.0641	39.47	60.52

Examination of the data given in Tables I—IV shows that:—

(a) the distribution of potash, phosphoric acid, total ash and nitrogen between juice and megass is similar for the different varieties examined for the two years under review.

(b) approximately 62 per cent. of the potash, 53 per cent. of the phosphoric acid, 41 per cent of the total ash and 40 per cent. of the nitrogen which were present in the whole cane, were expressed in the juice.

(b) *The Correlation between Juice and Cane Analyses.*

In order to assess how representative the juice analyses were of the whole cane, the correlations between the seventy-six series of analyses for juice and cane were evaluated. The results are set out in Table V, and it will be noted that the correlations are high and positive showing that the juice analyses, in respect of the determinations made, will be a good comparative indication of the analysis of the cane as a whole.

TABLE V.

	Ash in Juice and Ash in Cane.	Potash in Juice and Potash in Cane.	Phosphoric Acid in Juice and Phosphoric Acid in Cane.	Nitrogen in Juice and Nitrogen in Cane.
Correlation Co-efficient	+ 0.8079	+ 0.9253	+ 0.9649	+ 0.8053

(2) THE DIFFERENTIAL RESPONSE OF VARIETIES TO SIMILAR SOIL AND CLIMATIC CONDITIONS.

The juices expressed from the cane of the varieties Ba.11569, B.417, B.381, B.374, B.H.10(12) and White Transparent, were analysed in respect of potash, phosphoric acid, total ash and nitrogen. In 1928, the varieties Ba.11569, B.417, B.374 and B.H.10(12) were all grown at twenty centres and the figures given in Table VI, represent the mean of twenty determinations for each variety. The data have been examined statistically and it is found that there are no significant differences between the potash, phosphoric acid or ash content of the varieties Ba.11569 and B.H.10(12), when grown at similar centres and under similar climatic conditions. The varieties B.417 and B.374, however, have a significantly higher ash content than the varieties Ba.11569 and B.H. 10(12) and between 30 and 40 per cent. of this increase in the ash is due to potash. The phosphoric acid contents of the four varieties are not significantly different.

TABLE VI.

NUMBER OF CENTRES—20.

	Ba.11569	B.417	B.H. 10(12)	B.374
% K_2O in Juice ..	0.0747	0.0923	0.0771	0.0985
% P in Juice ..	0.0384	0.0402	0.0380	0.0454
% Ash in Juice ..	0.2750	0.3280	0.2768	0.3284

In 1929, the varieties Ba.11569, B.381, B.417 and White Transparent were grown at the same eighteen centres and the figures for the mean analyses are given in Table VII.

TABLE VII.

NUMBER OF CENTRES—18.

	Ba.11569	B.381	B.417	White Transparent
% K_2O in Juice ..	0.0792	0.0737	0.1061	0.0940
% P_2O_5 in Juice ..	0.0151	0.0155	0.0159	0.0147
% Ash in Juice ..	0.2571	0.2578	0.3198	0.3052
% N in Juice ..	0.0363	0.0317	0.0343	0.0433

The figures obtained in 1929 confirm the figures obtained in the previous year and show that the composition of the juice is a varietal characteristic. The variety White Transparent can be classified with B.417 and B.374 as having a significantly higher potash and ash content in the juice than the varieties Ba.11569, B.381 and B.H.10(12), when grown under similar soil and climatic conditions.

The statistical examination of the nitrogen figures shows that the variety White Transparent has a significantly higher percentage of nitrogen in the juice than the three varieties Ba.11569, B.381 and B.417.

An interesting point which arises in connection with these analyses is that the varieties B.417, B.374 and White Transparent absorb from the soil similar quantities of phosphoric acid, but different quantities of potash to the varieties Ba.11569, B.381 and B.H.10(12). This means that different cane varieties may show a differential absorption of nutrients when growing under similar soil conditions. In view of this fact, it is possible that varieties of sugar cane may show a differential response to manuring. For instance, in the case of

the varieties under consideration, the varieties B.417, B.374 and White Transparent, which take up more potash from the soil, may respond to larger dressings of potash than the varieties Ba.11569, B.H.10(12) or B.381.

(3) THE DIFFERENTIAL RESPONSE OF VARIETIES TO SIMILAR SOIL, BUT DIFFERENT CLIMATIC CONDITIONS.

In order to investigate the effect of different climatic conditions on the composition of the juice, the juices from the varieties Ba.11569, B.417 and B.381 were analysed during three successive crop seasons, viz., 1928, 1929 and 1930. The cane was obtained from the variety trial plots which were situated at twenty-six centres, so that the figures for each variety given in Table VIII represent the mean values of twenty-six determinations. The twenty-six centres were at similar plantations for each of the three years although the cane was not grown on the same fields. Each centre, however, should represent essentially similar soil conditions.

TABLE VIII.

NUMBER OF CENTRES—26.

	1927-28.			1928-29.			1929-30.		
	Ba.11569	B.417	B.381	Ba.11569	B.417	B.381	Ba.11569	B.417	B.381
% K_2O in Juice	0·0807	0·0965	0·0817	0·0753	0·0945	0·0704	0·0838	0·1089	0·0876
% P_2O_5 in Juice	0·0382	0·0399	0·0401	0·0154	0·0162	0·0146	0·0398	0·0413	0·0420
% Ash in Juice	0·2832	0·3345	0·2795	0·2473	0·3003	0·2567	0·2381	0·2944	0·2441
% Nitrogen in Juice	—	—	—	0·0363	0·0333	0·0309	0·0396	0·0375	0·0322

The data reported in Table VIII show that the relative order in which the three varieties stand to one another in respect of the percentages of potash, phosphoric acid, ash and nitrogen in the juice remains the same from year to year and is apparently unaffected by climatic changes.

The percentages of phosphoric acid in the juice of the cane for the growing season of 1928—29 is very much lower than for the seasons 1927—28 and 1929—30 and would appear to be due to some difference in climatic conditions. The differences between the other figures from year to year are not large and it is not possible to determine to what extent, if any, differences in climatic conditions account for these differences.

(4) THE ASH ANALYSIS OF SUGAR CANE GROWN ON MANURIAL TRIAL PLOTS.

(a) *A Phosphate Trial.*

The plan of this manurial trial was on the A.B.B.A. method of Student with ten replicates of each treatment. The basal manuring of all the plots was at the rate of 134 lb. nitrogen as sulphate of ammonia and 134 lb. potash as muriate of potash per acre.

The A plots received no phosphoric acid, whilst the B plots received superphosphate at the rate of 72 lb. phosphoric acid per acre.

Two samples of cane from the A plots and from the B plots were selected at random and analysed for phosphoric acid and potash.

The results of this trial are set out in Table IX.

TABLE IX.

Treatment per acre. lb.			Yield Tons per acre. (Mean of 10)	Purity of Juice.	% P_2O_5 in Juice.	% K_2O in Juice.
N.	P_2O_5	K_2O				
134	..	134	34.86	88.1	.0272 .0278	.0754 .0787
134	72	134	34.83	88.6	.0279 .0310	.1274 .1174

The results given in Table IX show that the phosphoric acid applied in the manure has had no effect on the yield of cane, purity of juice or per cent. phosphoric acid in the juice. It will be noticed, however, that the percentages of potash in the juices from the plots treated with phosphoric acid are considerably higher than in the juices from the no-phosphate plot. It would therefore appear that the phosphatic manuring has increased the percentage of potash in the juice.

(b) *A Complex Trial.*

The principal object of this trial was to test the effect of varying combinations of nitrogen, phosphoric acid and potash on the yield of cane and purity of juice. The opportunity, however, was taken of analysing the juice for other constituents.

The lay-out of the trial was in the form of randomised blocks and was put down at two centres. Centre I was representative of red soil conditions in a high rainfall district and centre II was representative of black soil conditions in a moderately low rainfall district. Both centres were situated on the coral limestone formation.

At centre I, the yield results showed that the soil was deficient in potash and increases of 8—9 tons of cane per acre were obtained with dressings equivalent to 100 lb. potash per acre. There was no response to phosphatic manuring; in fact the results of all manurial trials carried out to date have shown that sugar cane growing on the coral limestone soils of Barbados will not respond to phosphatic fertilizers.

At centre II, the yield results show that the soil was in "good heart" and no response was obtained either to phosphatic or potassic manuring.

In Table X, the mean effect of 60 lb. phosphoric acid and 100 lb. potash per acre on the percentages of phosphoric acid and potash in the juice are shown for the two centres.

TABLE X.

Effect of	Centre I.		Centre II.	
	% P_2O_5 in Juice.	% K_2O in Juice.	% P_2O_5 in Juice.	% K_2O in Juice.
60 lb. P_2O_5 per acre (Mean of 8)	.0287	.0940	.0299	.0714
No P_2O_5 (Mean of 4)	.0310	.0800	.0304	.0737
100 lb. K_2O per acre (Mean of 8)	.0298	.0937	.0299	.0753
No K_2O (Mean of 4)	.0292	.0806	.0304	.0632

The results are of considerable interest; phosphatic manuring does not appear to have had any significant effect on the phosphoric acid in the juice of the cane. At centre I, however, where the yield of cane was limited by a deficiency of potash in the soil, the addition of phosphate in the manure appears to have increased the percentage of potash in the juice. This is similar to the effect observed, and already reported on, in Section (4) (a). At centre II, however, where there was no deficiency of potash in the soil, the phosphatic manuring has had no apparent effect on the per cent. potash in the juice.

The effect of potash in the manure has been to raise the percentage of potash in the juice, both at centres I and II: that is, under soil conditions representing both a deficiency and a sufficiency of potash. The potash manuring has apparently had no effect on the percentage of phosphoric acid in the juice.

It may be further noted that the mean percentage of potash in the juice at the black soil centre where there was no potash deficiency in the soil, was 0.0713 per cent. whilst at the red soil centre where the cane responded to potash manuring, the mean percentage of potash in the juice was 0.0893 per cent.

The results set out in this paper indicate that, under Barbados conditions, the analysis of sugar cane juices would be of little value in determining possible soil deficiencies.

The following are the salient conclusions which may be deduced in respect of the percentages of ash, potash, phosphoric acid and nitrogen in the juice of sugar cane grown on the coral limestone soils of Barbados.

(a) There is a high positive correlation between juice and cane analyses indicating that any conclusions arrived at from a study of juice analyses can be equally applied to cane analyses.

(b) The relative distribution of constituents between juice and megass are given, and it is shown that this distribution is very similar for different varieties and for different years.

(c) Under similar soil and climatic conditions, different varieties may show a differential absorption of potash from the soil.

(d) The composition of the juice of a given variety grown under similar soil conditions, may vary from year to year under different climatic conditions. This appears to apply more especially to the percentage of phosphoric acid in the juice.

(e) In certain cases, phosphatic manuring appears to increase the percentage of potash in the juice.

(f) Sugar cane growing on soil deficient in potash may have a greater percentage of potash in the juice than cane growing on soil not deficient in this constituent. In this connection, it should be noted that the soil, in the two cases, was not of exactly the same type.

(g) Increases in the potash manuring are followed by increases in the percentage of potash in the juice.

(h) Under Barbados conditions, phosphatic manuring does not appear to increase the percentage of phosphoric acid in the juice. Manurial trials show that sugar cane growing on the coral limestone soils of Barbados does not respond to phosphatic fertilizer.